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Tutorial-04

Ques1

$T(n) = 3T(n/2) + n^2$

$\rightarrow a = 3, \quad b = 2, \quad f(n) = n^2$

$n^{\log_b a} = n^{\log_2 3}$

$\because n^{\log_2 3} < f(n)$

$\therefore T(n) = \theta(n^2)$

Ques2

$T(n) = 4T(n/2) + n^2$

$a = 4, \quad b = 2, \quad f(n) = n^2$

$n^{\log_b a} = n^{\log_2 4} = n^2$

$n^{\log_b a} = f(n)$

$\therefore T(n) = \theta(n^2 \log n)$

Ques3

$T(n) = T(n/2) + 2^n$

$\rightarrow a = 1, \quad b = 2, \quad f(n) = 2^n$

$n^{\log_b a} = n^{\log_2 1} = n^0 = 1$

$n^{\log_b a} < f(n)$

$T(n) = \theta(2^n)$

Ques4

$T(n) = 2^n + T(n/2) + n$

$\therefore a$ is a function

master theorem is not possible.

Ques5

$T(n) = 16T(n/4) + n$

$a = 16, \quad b = 4, \quad f(n) = n$

$n^{\log_b a} = n^{\log_4 4^2} = n^2$

$n^{\log_b a} > f(n)$

$T(n) = \theta(n^2) \quad \underline{Ans}$

Ques 6

$T(n) = 2T(n/2) + n \log n$

$a = 2, \ b = 2, \ f(n) = n \log n$

$n^{\log_b a} = n^{\log_2 2} = n$

$n^{\log_b a} < f(n)$

$T(n) = \Theta(f(n)) = \Theta(n \log n)$

Ques 7

$T(n) = 2T(n/2) + n/\log n$

$\rightarrow a = 2, \ b = 2, \ f(n) = n/\log n$

$n^{\log_b a} = n^{\log_2 2} = n$

$n^{\log_b a} > f(n)$

$\underline{T(n) = \Theta(n)}$

Ques 8

$T(n) = 2T(n/4) + n^{0.51}$

$a = 2, \ b = 4, \ f(n) = n^{0.51}$

$n^{\log_b a} = n^{\log_4 2} = n^{1/2} = \sqrt{n}$

$n^{\log_b a} < f(n)$

$T(n) = \Theta(f(n)) = \Theta(n^{0.51})$ An

Ques 9

$T(n) = 0.5T(n/2) + 1/n$

$a < 1$, master theorem is not applicable

Ques 10

$T(n) = 16T(n/4) + n!$

$a = 16, \ b = 4, \ f(n) = n!$

$n^{\log_b a} = n^{\log_4 16} = n^2$

$n^{\log_b a} < f(n)$

$T(n) = \Theta(n^2)$ An

Ques 11

$T(n) = 4T(n/2) + \log n$

$a = 4, \ b = 2, \ f(n) = \log n$

$n^{\log_b a} = n^{\log_2 4} = n^2$

$T(n) = \Theta(n^2)$

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Ques 12

$T(n) = $ sqrt $(n) T(n/2) + \log n$

$\therefore a$ is not constant

master theorem is not applicable.

Q.13)

$T(n) = 3T(n/2) + n$

$a = 3, b = 2, f(n) = n$

$n^{\log_2 3} = n^{1.58}$

$n^{\log_2 3} > f(n)$

$\underline{T(n) = \theta(n^{1.58})}$

Ques 14

$T(n) = 3T(n/3) + \sqrt{n}$

$\rightarrow a = 3, b = 3, f(n) = \sqrt{n}$

$n^{\log_3 3} = n$

$f(n) = \theta(n)$

Ques 15

$T(n) = 4T(n/2) + cn$

$\rightarrow a = 4, b = 2, f(n) = cn$

$n^{\log_b a} = n^{\log_2 4} = n^2$

$n^{\log_b a} \gg f(n)$

$\underline{T(n) = \theta(n^2)}$

Q.ues 16

$T(n) = 3T(n/4) + n \log n$

$a = 3, b = 4, f(n) = n \log n$

$n^{\log_4 3} = n^{0.79}$

$n^{\log_b a} < f(n)$

$\underline{T(n) = \theta(n \log n)}$

Ques 17

$T(n) = 3T(n/3) + n/2$

$a = 3, b = 3, f(n) = n/2$

$n^{\log_b a} = n^{\log_3 3} = n$

$n^{\log_b a} > f(n)$

$\underline{f(n) = \theta(n)}$

Ques 18

$T(n) = 6T(n/3) + n^2 \log n$

$\rightarrow a = 6, \ b = 3, \ f(n) = n^2 \log n$

$n^{\log_b a} = n^{1.63}$

$T(n) = \Theta(n^2 \log n)$

Ques 19

$T(n) = 4T(n/2) + n/\log n$

$a = 4, \ b = 2, \ f(n) = n/\log n$

$n^{\log_b a} = n^2$

$T(n) = \Theta(n^2)$

Ques 20

$T(n) = 64T(n/8) - n^2 \log n$

$f(n)$ is not increasing function so master's theorem is not applicable.

Ques 21

$T(n) = 7T(n/3) + n^2$

$a = 7, \ b = 3, \ f(n) = n^2$

$n^{\log_b a} = n^{\log_3 7} = n^{1.3}$

$n^{\log_b a} < f(n)$

$T(n) = \Theta(n^2)$

Ques 22

$T(n) = T(n/2) + n(2 - \log n)$

Master's theorem is not applicable.

$\therefore$ regularity condition is isolated in case 3.

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